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Journal of the Society of Arts.

FRIDAY, JANUARY 18, 1856.

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SIXTH ORDINARY MEETING.

Wednesday, January 16, 1856.

The Sixth Ordinary Meeting of the One Hundred and Second Session was held on Wednesday, the 16th inst., Capt. J. M. Laws, R.N., in the chair.

The following Candidates were balloted for and duly elected :—

Bleekrode, Professor
Clark, Joseph Lester
Dixon, Thomas
Evans, Frederick Mullett, jun.
Labalmondiere, George

The following Institutions have been taken into Union since the last announcement :—

408. London, Eastern Counties Railway Mechanics' Institute and Stratford Literary Society.
409. Prees (near Shrewsbury), Mutual Improvement Society.

The Paper read was :—

ON TONNAGE REGISTRATION.

By Charles Atherton, Member of the Institution of Civil Engineers, and of the Society of Arts, Chief Engineer Royal Dockyard, Woolwich.

In a paper read before the Society of Arts on the 16th of May last, the capabilities of steam ships as locomotive machines for the conveyance of mercantile cargo, were subjected to investigation. In that paper, the mutual relation of displacement of the ship, working power of the engines, and speed realised, was taken as the elementary base of calculation, whereby the relative locomotive efficiency of different types of vessels constructed for the purpose of goods transport service might be compared; and the importance of the inquiry was demonstrated by showing the great difference in point of pecuniary economy that actually exists between ships of different type of build, though both of ordinarily good repute, when put to the test of performing a specific service by the agency of steam alone: this was exemplified by investigating the results of performing a given service by vessels of certain definite and actually existing types of build, and it was shown that a difference of constructive type, almost inappreciable to common observation, might enhance the cost of freight 100 per cent. and upwards. This result, as set forth in the former paper, is now referred to for the purpose of keeping in view the commercial £ s. d. importance of the subject. The practical object of the investigation now proposed for further discussion may be summed up as follows: namely, to determine what steps are necessary to be taken in order that tonnage registration may embrace the elementary data by which the locomotive qualities of ships may be comparatively determined and duly appreciated, and whereby especially those general principles of construction and types of build may become adopted which are most conducive to transport economy, and, therefore, it may be presumed, most beneficial to the public interests. In the former paper the question of engine-power in reference to steam ships was disposed of, by exposing the utter vagueness of the term "nominal horse-power" in our present commercial practice, and pointing out the necessity for some definite measure of power being recognised in official registration, as the legal standard measure of the unit of power to be denoted by the term "marine horse-power;" we now come to that division of our subject which is especially proposed for investigation in this paper, namely, "Tonnage Registration." In the first place, let us inquire what is the meaning of the term Tonnage, as made use of in shipping-registration under the now existing law, namely, the Mercantile Shipping Act of 1854; what matter-of-fact or measurable reality does the term *tonnage* signify; has the *tonnage* of a ship any specific relation either to the displacement of the ship or to the nett tons weight of cargo that a ship will carry, or to the quantity of cargo that a ship will hold? does the registered *tonnage* correctly answer any purpose as the base of calculation in commerce, or as preventing fiscal imposition? does it equitably constitute the base of building contracts; or answer any useful purpose in scientific inquiry, as affording elementary data available for determining the relative locomotive merits of ships? Finally, does the registration of *tonnage*, under the existing law, afford any information whereby cupidity and recklessness in the loading of ships can be officially exposed or checked in a manner conducive to the safety of property and life? Such are the points which we purpose inquring into, and if the present system of Tonnage Registration does not fulfil these requirements, it is purposed to submit for the consideration of the Society such suggestions as may conduce to the attainment of those objects.

Preparatory to entering upon these inquiries, with reference to the existing law for regulating the measurement of tonnage, as embodied in the Merchant Shipping Bill of 1854, it may be well to refer summarily to the preceding various enactments which have been enforced for regulating the admeasurement of shipping, show what *tonnage* originally meant, trace the various changes which have taken place in the law of tonnage, and scrutinise the grounds on which from time to time such changes appear to have been introduced. Mr. Moorsom, in his "Review of the Laws of Tonnage," has collated the various legislative enactments bearing on this subject.

It appears that the necessity for placing the loading of colliers under legal restriction attracted the notice of the legislature in 1422, the ninth year of the reign of King Henry V., when it was enacted that "keels that carry coal at Newcastle shall be *measured* and *marked.*" No further legislative notice appears to have been taken thereof till 1648, when, by Act 13th Charles II., it was enacted, "That commissioners should from time to time be appointed, for the *admeasuring* and *marking* all and every the keels and other boats to be used for the carriage of coal in the port of Newcastle, and all other places within the counties of Northumberland and Durham." It does not appear to have been specified, either by 9th Henry V. or 13th Charles II., what was to be the precise principle and method of admeasurement and marking thus enforced; but subsequently, in the year 1694, by Act 6th and 7th William and Mary, it was enacted that "the admeasurement shall be by a dead weight of lead or iron, *allowing three and fifty hundred-weight to every chaldron of coal,*" and that "the said keels and boats so admeasured should be *marked* and *nailed* on each side of the stem and stern and midships thereof." Thus, in the year 1694, a complete system was established whereby the nett *chaldronage* of the Northumberland and Durham colliers was indicated by ostensible marks on both sides of the stem, stern, and amidships, which system of admeasurement was afterwards extended to vessels used in loading coal at "all other ports of Great Britain," the vessels, as before, to "be admeasured by a dead weight of lead or iron, allowing 20 hundred-weight avoirdupois to the TON, and marked and nailed as aforesaid, to denote what quantity of coal each will carry up to the mark so set thereon." Thus, instead of the cargo being denoted, as previously, by chaldrons of coal rated at 53 cwts. per chaldron, the marks on both sides of the stem, stern, and midships were now made to denote Tonnage of cargo at the rate of 20 cwts. avoirdupois to the ton,—practically determined by placing on board such weights of lead or iron, and the corresponding marking or nailing at the water's surface, being made accordingly. The Acts above referred to relate exclusively to craft engaged in the coal trade in British ports; but, in 1720, it was determined to bring vessels engaged in the foreign spirit trade within the operation of the tonnage laws, and accordingly, in 1720, by Act 6th George I., it was enacted that the following rule for determining the admeasurement of ships laden with brandy and other spirits shall be observed, that is to say:—"Take the length of the keel within board (so much as she treads upon the ground), and the breadth within board by the midship beam, from plank to plank, *and half the breadth for the depth;* then multiply the length by the breadth, and that product by the depth (or half the breadth), and divide the whole by 94: the quotient will give the true contents of the tonnage."

By this Act of 1720, 6th George I., the registered tonnage had no longer any direct reference to the weight that would actually sink the vessel down to any specific line of draught; no legalised limit is assigned to the draught of water, and, consequently, there is no prescribed limit to the *weight* of cargo that may be shipped on board short of that which will sink the ship; moreover, the real depth of the hold of the vessel may be either greater or less than the half-beam; consequently, the rule affords no criterion whatever even of the internal capacity or roomage of the vessel, nor yet of the *quantity by measure* that the ship might hold. It is possible that, with reference to some one proportion of build, or to the usual practice of ship-building at that time, the resultant of the prescribed rule may then have been a number corresponding either to the number of tons weight that ships may have carried at their usual deep-draught immersion, or possibly the resultant of the prescribed rule may then have given a number corresponding to a certain amount of measurement tonnage rated at 40 feet, or some other conventional number of cubic feet to the ton; but whether *bulk* of cargo or *weight* of cargo was intended to be embraced by this law of tonnage is not stated, and as regards its general application to the measurement of dissimilar vessels, the rule is merely an arbitrary combination of figures, devoid of all mathematical principle as a rule of admeasurement, resulting in a number that is called tonnage, but, nevertheless, not necessarily representing, even approximately, either the internal roomage for cargo, or the tons weight of cargo that a ship would carry, or to which she might be restricted. It is to be observed, that the abortiveness of the above rule, as prescribed in 1720, by Act 6th George I., is chiefly attributable to the limitation of the deep draught by *nailing* having been abandoned, and to the *depth* of hold having been discarded from the calculation, by half the breadth having been assumed in lieu thereof. This Act, 6th Geo. I., was the origin of all the now tap-rooted delusion in regard to tonnage which subsists in Britain even up to the present day. Be it observed, that the French never adopted this absurdity of attempting to compare the cubature of dissimilar bodies by taking cognizance of two dimensions only.

We now come to the year 1773, Act 13th Geo. III., when the legislature deemed it expedient that one certain rule should be settled and established, and applied in all cases where the tonnage of ships or vessels trading to or from this kingdom was necessary to be known or ascertained, still excepting the vessels used in carrying coal and those employed in the British white-herring fisheries. Accordingly, in 1773, by Act 13th Geo. III., c. 74, the general rule for the admeasurement of ships or vessels was prescribed to be as follows:—"The length shall be taken on a straight line along the rabbet of the keel of the ship, from the back of the main stern-post to a perpendicular line from the forepart of the main stem under the bowsprit, from which subtracting three-fifths of the breadth, the remainder shall be esteemed the just length of the keel to find the tonnage; and the breadth shall be taken from the outside of the outside plank in the broadest place in the ship, be it either above or below the main wales, exclusive of all manner of doubling planks that may be wrought upon the sides of the ship; then multiplying the *length* of the keel by the *breadth* so taken, and the product by *half the breadth*, and, dividing the whole by 94, the quotient shall be deemed the true contents of the tonnage." By this act of 1773, 13th Geo. III., we have *external* measurement substituted for the previous *internal* measurement, but still it was not stated whether tonnage was intended to signify *weight* of cargo or *space* for cargo; also, no direct cognizance is taken of depth, half the breadth being taken in lieu thereof, and no limitation is assigned to the draught, thus the fundamental errors and deficiencies of 6th Geo. I., were continued and confirmed by 13th Geo. III. Subsequently, in 1786, it was enacted by 26th Geo. III., c. 60, "that, in the case of measuring *vessels afloat*, the length shall be taken at the *load waterline*, from the back of the sternpost to the front of the main stem, 'subtracting therefrom 3 inches, for every foot of load draught of water for the rake abaft, and three-fifths of the ship's breadth for the rake forward, the remainder being the length of the keel for tonnage.'" The rest of the rule was continued as before. Here we have the load-water line referred to, but the position of the said load line below the deck, with reference to the beam of the vessel or other limitation, is not specified. And again, in 1819, by Act 59 Geo. III., c. 5, it was enacted, "that in the rules established for the admeasurement of ships, when used for ascertaining the tonnage of any ship or vessel propelled by STEAM, the length of the engine-room shall be deducted from the length of the keel for tonnage, the remainder being esteemed the just length of the keel to find the tonnage." Hence it will be perceived, that the Act of 1773, and the extensions thereof of 1786 and 1819, took no direct cognizance either of the deep draught of water of the vessel or of the depth of hold; it was only length and breadth that were recognised as elements in the admeasurement of tonnage, and, consequently, the rule cannot be a correct, or even a comparative measurement of dissimilar vessels, either as respects displacement or internal roomage. Nevertheless, the rule was adopted, and devices were resorted to by shipping proprietors for taking advantage of the defects of the law, in such manner that the real capacities and capabilities of ships for cargo, whether by weight or measurement, might greatly exceed the nominal tonnage by which fiscal dues on shipping were usually regulated. The law thus afforded a suicidal protection to British shipping, for to such length were these evasions carried, that they induced the construction of dull sailing vessels, highly detrimental to public interests, so much so that, in 1821, the public evils induced thereby again attracted the attention of the legislature, and a commission was appointed to inquire into the subject. The commissioners reported, in 1821, that "there are sufficient reasons for being dissatisfied with the mode of admeasurement now legally employed;" that "they would have been desirous of removing all doubt on the subject, by proposing the admeasurement of *that portion of the ship which is included between the light and heavy water-lines*," but "this method has been considered as liable to insuperable objections, on account of the impossibility of ascertaining the positions of these lines in a satisfactory manner;" and they proceeded to propose the adoption of an entirely new method of measurement and computation of tonnage, based on *internal* measurement, but the proposed amendments were not adopted by the legislature, and the old laws continued in force. Again, in 1833, a second commission was appointed "to consider the best means of measuring the tonnage of ships." The commissioners, in their report of 1834, state, that the "internal capacity will be the fairest standard of measurement, including all those parts of a vessel which, being under cover of permanent decks, are available for stowage," and, "that a rule of such general application should depend on the smallest number of measurements necessary to give the figure of the hull, and that it should afford results sufficiently exact for the required purpose by an easy arithmetical process."

Two rules based on *internal* measurement were prescribed by this Committee of 1833, namely, rule No. 1, for the measurement of vessels for register tonnage while the hold is *clear;* rule No. 2, for the measurement of *loaded* vessels. These rules were legalised in 1834, by Act 5th and 6th William IV., c. 56, amended by 6th and 7th Victoria, c. 84, and consolidated by 8th and 9th Victoria, c. 89. Thus a new system, based on *internal* admeasurement, and intended to totally supersede the old law, 13th Geo. III., c. 74, now became legalised; nevertheless, whether from the complexity of the new rules as compared with the old law, or the difficulty of introducing any change in long established usage, these new rules failed to give satisfaction; the old law, though repealed, continued to be generally acted upon as the base of shipping operations, and the new law being thus inoperative, Government, in 1849, instituted a third commission, for the purpose of inquiring into the defects of measuring ships for tonnage, and to frame a more perfect rule. This third commission reported as follows:—"That the equitable basis on which charges for dock, light, harbour, and other dues should be made, is that of the entire cubic contents of all vessels measured *externally*," and "that inasmuch as the poop, forecastle, and other covered-in spaces, are directly or indirectly a source of earnings from cargo or passengers, those spaces should be all measured." Accordingly, the rule proposed by this, the third commission, included the *external* bulk of the vessel up to the medium height of the upper side of the weather deck. It was proposed that this cubical mensuration of the vessel should be divided by 35, thus giving the total displacement in tons weight, supposing the vessel to be immersed down to the medium height of the weather deck, and that the quotient should be multiplied by the factor ·27, in order that the new register tonnage of ships might, on the average, accord with the register tonnage under the old law; also, for the measurement of vessels *afloat*, a system of girting the vessel was proposed. These proposed rules of the third commission were not favourably received by the shipping interests, and were not adopted by the legislature, consequently, the rules proposed by the second committee, called the new admeasurement, as legalized in 1834, by Act 5th and 6th Wm. IV., c. 56, consolidated 8th and 9th Vict., c. 89, continued to be the law of the land; but, nevertheless, the old law of 1773, 13th George III., though thus repealed, continued to be generally received and acted upon in commercial arrangements, especially as the base of tonnage measurement in ship-building contracts.

We now come to the fourth commission, appointed for revision of the tonnage law and for the consolidation of the various Acts relating to merchant shipping, resulting in the Merchant Shipping Bill of 1854, 17th and 18th Victoria, c. 104.

Under this Act of 1854, a system of tonnage admeasurement based on internal capacity, but reduced by a factor (divisor 100) in order that the aggregate of tonnage, as measured by this new law, might correspond with the aggregate if measured by the old law, has now become the law of the land; and although this commission commenced its labours under the avowed and recorded declaration, "that it is desirable to establish an easy practical mode of admeasurement," the specification merely of the outline of the system of admeasurement as prescribed by this bill of 1854, occupies no less than ten clauses in the Act; and the detail of working out the calculations, to be properly understood and not done by rote, demands a course of laborious mathematical study. This system being merely the application of mathematical routine to the cubature of bodies, its accuracy may be admitted, but the prescribed detail of instructions to meet various sizes of ships and various peculiarities of construction, have been made so multifarious as to complicate the application of the system, and to render the practical operation whereby the results are obtained a mystery, unintelligible to every body excepting those who make it a professional study. It has already been felt that this law of admeasurement as respects its application to *ordinary* mercantile purposes is, by reason of its complication, abortive, and, consequently, the simple rule of the old law of 1773, 13th George III., denominated "builders' measurement," with all its glaring defects, still continues to be almost universally recognised as the base of mercantile contracts for the purchasing and building of ships. Such is the history of tonnage down to the present time.

It is not proposed at present to take exception to the system of internal measurement as prescribed by the Merchant Shipping Bill of 1854, merely on account of the complications which have thus been made to attend its practical application. The question now raised is one of PRINCIPLE, namely, whether or not the measurement of *internal roomage only* being made the base of "tonnage" is of itself effective for the attainment of the objects for which tonnage registration has been established. This brings us back to the various points of inquiry proposed for consideration in the first part of this paper. *Firstly,* then, what is the meaning of the term "*tonnage*," as made use of in the Merchant Shipping Bill of 1854? The Act itself does not specifically define whether weight or measure is intended to be signified by the term tonnage; but, by a recorded resolution of the commission, we find it to have been their avowed object to "produce as nearly as possible, the same results as under the former system of admeasurement commonly termed, the Old Law or Builders' Measurement;" that is to say, that after having taken infinite pains for accurately measuring the roomage of ships, the reduction of this roomage measurement should be such as would produce the same amount of aggregate *nominal tonnage* as by the old law; to attain which result it is found necessary to divide the roomage taken in cubic feet by the factor or divisor 100, so that if the old law falsified the aggregate tonnage of the country, the new law would perpetuate the error. Now, the old law took no direct cognizance whatever of the *draught of water* of a ship either light or loaded; and, consequently, it did not measure the capability of a ship for carrying weight. Hence it follows that tonnage, under the new law, has no reference whatever to the tons weight which a ship will carry, but means that a ship of given tonnage has the available internal capacity of 100 cubic feet for each ton of such *nominal tonnage.* Hence, tonnage, under the new law, means simply roomage; then, why not call it roomage? The very term *tonnage* implies the capability of a ship for carrying *weight* burden; but one may as well talk of a ton of time, or of a ton of distance, as of a ton of space or roomage, unless a specified measure of space be conventionally appropriated to the term "ton," and there is no conventional usage in commerce which appropriates 100 cubic feet of space or roomage as the unit of goods measurement for freight. A proper nomenclature in the registration of shipping, is undoubtedly indispensable to system and efficiency in conducting shipping operations.

Secondly.—Does the adoption of internal measurement as the base of registration constitute, as it is professed to do, any guarantee or inducement to builders tending to improvement in the form and build of shipping? It is no argument of mine whether or not one system of admeasurement more than another would so far influence builders as to induce the building of a good or bad form of vessel, or the using of a greater or less quantity of material in the construction of a ship of specified size—I disclaim all such inference; but, as it has been urged that the system of internal measurement would in these respects conduce to public good more than any other system of admeasurement; and as the perfect efficacy for good, of internal measurement, has by its advocates been presumed to be proved simply because extreme cases of other systems may have been by them logically run down to the "*reductio ad absurdum,*" I would merely notice that as regards the forms of ships, a given amount of material would produce the greatest amount of internal roomage by adopting a hemisphere as the form of the ship; but as the hemispherical hull would, in point of workmanship, be a very expensive form, it would be still more to the interest of the builder, who should unworthily allow himself to be influenced by the temptation afforded by internal measurement to make a ship of specified size at the least cost, to adopt the Tub as his type of build,—and surely between the "*reductio ad absurdum*" and the "*reductio ad Tub*," there is not much to choose. I, therefore, do not admit that the adoption of internal measurement as the base of tonnage does of itself, necessarily, induce an improved type of build, as respects either form or strength, as has been so strongly urged in favour of that system by its advocates; and as regards the assertion that internal measurement would afford the best security for the equitable rating of fiscal dues, I would also question this result by observing, that a ship might be constructed on the cellular principle of build, as adopted in the great leviathan iron vessel now building on the Thames, carrying this principle of build to such extent, that in a vessel measuring 35,000 cubic feet, or 1000 tons displacement between the light and load draught water lines, the hold of the vessel might measure only 10,000 cubic feet. Such a vessel would both stow and carry 1000 tons weight of pig iron, railway bars, or such like goods, but her tonnage by the prescribed rule of internal measurement, at the rate of 100 feet per ton, would be 100 tons, being only one-tenth part of her weight cargo. Again, on the contrary, 1000 tons of cotton or wool would probably require 160,000 cubic feet of internal roomage, that is, a ship of 1600 tons nominal tonnage—thus, the 1000 tons of cotton or wool would be charged with sixteen times the amount of ship's tonnage dues that would be paid on the 1000 tons of iron, unless, indeed, in both cases, we adopt the principle of the raft, in which case, placing the cargo on deck, the tonnage would be 0. We may, therefore, under the present law of internal measurement, have a floating mass of any form, possessing but little, if any, internally measurable space; in fact, a ship without tonnage, but I have not yet learnt that a floating mass can exist without externally measurable bulk; it is, therefore, not admitted that internal measurement necessarily insures fiscal justice.

Thirdly.—Does registration, based on internal measurement, pre-eminently above all other systems of measurement, afford elementary data of any use towards determining the relative *locomotive* MERITS of ships? On this point, as the details of *internal* measurement afford no record of *external* length, breadth, or draught of water, such measurement does not necessarily afford a measure of the displacement; and as displacement is an essential element in determining the relative locomotive merits of ships of different size and type of build, I do not perceive in what respect a record based on internal measurement only would facilitate scientific analysis, or afford the means of testing the *comparative* adaptation of different types of build for easy propulsion by steam or sail.

Fourthly.—Does the present law of registration, based only on internal measurement, afford any data tending to check the loading of ships to such extent as might endanger the safety of property and life? The importance of this point of consideration cannot, in my opinion, be more strikingly exemplified than by reference to the official returns of shipwrecks on the shores of Britain. The aggregate of the annual loss of life and property by shipwreck, would not fail of striking the public mind with awe if publicly made known. It is much to be regretted that greater publicity is not given to the catalogue of annual shipwrecks of British shipping, in order that public opinion might be brought to bear on the correction of this the most monstrous of our national calamities, but the least thought of because of daily occurrence, and only made known in detail. The following summary is taken from the report of the Committee on Life-boats, originated by his Grace the Duke of Northumberland, in 1851:—

"From official returns, it appears that in the course of the year 1850, no less than 681 vessels were wrecked on the coasts and within the seas of the British Isles. Of these vessels, 277 were total wrecks, 84 were sunk by leaks or collisions, 16 were abandoned, and 304 were stranded or damaged so as to require them to discharge cargo, and, as nearly as can be determined, 780 lives were lost."

It will not, I presume, be doubted, that the too deep loading of ships constitutes one of the greatest sources of danger to which a ship can be exposed. Let us examine, then, whether internal measurement affords any check on such abuse. Now, measuring up to the very gunwales of a ship, it is not unusual for the internal roomage to be about 80 per cent. of the external cubature of a timber ship, and still more in an iron ship. Consequently, a timber vessel of 70,000 feet external cubature may have 56,000 feet of internal roomage. The total displacement of such a vessel, when immersed down to the deck level, would be 2,000 tons weight, and allowing 600 tons for the weight of the vessel herself, the sinking weight of cargo would be 1,400 tons weight, consequently, the vessel would sink if filled with a description of goods heavier than one ton weight to the 40 feet of cubic measure; but many descriptions of goods may be stowed at the rate of two tons to the 40 feet of cubic measure, therefore, with such a cargo, the vessel might be loaded down to the very gunwales, and be in a sinking condition when only one-half full. These figures have been adduced to show the liability of ships to be heedlessly overloaded, unless the LAW define some rule for regulating the *deep draught limit*, which check against the overloading of ships the present law does not afford. The nominal tonnage of the ship above cited, containing 56,000 feet of internal roomage, would indeed be rated at 560 tons register tonnage, but the law does not restrict the weight cargo of ships to their register tonnage, or to any other limit,—and such being the case, what is to prevent the point of safety from being exceeded? The effect of insurance only tends to increase the evil. A dangerously loaded ship, if well *insured*, may be regarded by the owner ashore with indifference as to the consequence of a raging storm. If a man purposely set fire to a house, and death ensue, he will certainly be amenable to the law; but a well-insured ship may be recklessly overloaded, and sunk with impunity and profit. Our present system of registration affords no check on such abuse. Why should the law regard arson as a crime while it imposes no limit to the loading of ships to such an extent that they may become unmanageable, and in danger of foundering if bad weather ensue? Yet such is the case, and the anomaly is the more striking, inasmuch as the victims by wreck at sea are probably 100 times more numerous than the victims by fire on shore.

Again, let us consider the active and publicly protective supervision of the legislature over railway management as compared with the same supervision over shipping. Happily for the public, public safety is vindicated by the strict investigation to which the occurrence of accident by railway is subjected, and who can estimate the amount of prevention of accidents which such official scrutiny into railway management is sure to create? We may, merely for exemplification of the details of government scrutiny in matters of railway management, refer to the report of the railway department of the Board of Trade on certain railway accidents in June, 1855. The subject matter of this report was regarded of such import as to be printed by order of government, to be presented to both houses of Parliament in August last, and it consists of the following cases:—

1st. An accident whereby one person was injured.

2nd. An accident tending to public danger, but by which, fortunately, only a carriage was injured.

3rd. An accident whereby one person was killed.

The small amount of personal injury consequent on these three accidents thus brought before the special notice of government by the Board of Trade, show the great importance that is most deservedly attached to the prevention and correction of defects in railway management.

The official investigation consequent on the accidents above-referred to, involved numerous details of railway management; for instance, the relative positions of ticket platforms, adjacent junctions, and signal stations, are all measured off to a foot and criticised, the habitual management of the traffic is inquired into, the practical operation of the machinery for working signals, points, and tongues, examined, the number of hands employed as pointsmen and signal men ascertained, also the number of waggons employed, and their loading, with reference to the numbers, power, and efficiency of the accompanying break, was fully investigated. The above enumerated details of inquiry with reference to these accidents exemplify the nature of government action in railway affairs for the protection of life. How strangely, then, does this detailed and scrutinising supervision of government over railways contrast with the fact that the deep draught of a ship, on which safety at sea so much depends, is left to the caprice of parties whose pecuniary interest consists in loading a ship to the utmost, and able to do so, there being no legalised limitation assigned thereto, no record taken thereof when a vessel leaves port, and no means of proof on this most vital matter available for judicial inquiry in the case of a ship foundering at sea with 500 souls on board. How strange is the contrast that the three railway accidents which occurred in June, 1855, involving the death of one person, the injury of another, and the breakage of a carriage, should thus be the subject of special report to both Houses of Parliament by command of her Majesty, whilst no official notice whatever has been taken of the 238 cases of shipwreck said to have occured in January of the same year. Further amplification on this subject, by quoting the fate of the *President* and 50 other instances of wholesale loss of life by the foundering of ships at sea, would be too painful an inquiry to be reagitated; it is hoped that mere allusion to such catastrophes will suffice, and by showing that these glaring and homicidal deficiencies of shipping registration do not pass unobserved, it is hoped that the evil may attract attention and its remedy be provided.

We now come to the point what is best to be done, in order that the registration of shipping may give not only the internal cubature, but embrace other matters of fact conveying information of commercial utility, conducive to the scientific improvement of shipping as locomotive machines, and to the protection of property and life. The question is public, open to perfect freedom of opinion, and there is no subject of inquiry more worthy of the Society of Arts.

In the first place, it may be observed, that the capability of a ship for carrying weight is a totally different thing from the capability of a ship for holding bulk—the one is no measure or indication of the other. A ship may be actually sunk with some descriptions of cargo before she is half full, and with other descriptions of cargo the same ship may be full before she is half loaded. The glaring deficiency of the Tonnage Registration Law has hitherto consisted in this—that it has never been expressly defined whether the legal signification of tonnage implies the capability of a ship for carrying weight, or the capability of a ship for holding bulk, and for want of such legalised definition of the term tonnage, men have been in the habit of applying to the term whatever signification may have best suited the interests and requirements of their own business. For instance; one merchant may expect a ship of 1000 tons register tonnage, to carry at least 1000 tons weight of cargo; another may expect her to carry at least 1000 tons measurement of light cargo, at the usual conventional measurement of 40 cubic feet to a ton. A shipowner claims the privilege of charging his freight either by the *weight* or by the *measurement* of the goods to be conveyed, as may best suit his interests; and again, the ship-builder still rates his building price per ton of tonnage as measured by the old law, without being thereby bound either as to what the ship shall carry, or what the ship shall hold, unless he specifically engage relative thereto. Thus, we have tonnage applied in four different significations, and implying as many totally different meanings. It is thus a conventional term, signifying anything, but defining nothing; truly, a fine field for commercial cleverness in the buying, selling, freighting, and chartering of ships. Is such a sham, especially in time of war, compatible with public good? Yet on the deficiencies of the present system of shipping registration being asserted, it has been responded that as the SHIPPING INTERESTS have not, by petition to the legislature, objected to the present law, the question of its amendment cannot be entertained. Why, whoever yet heard of any corporation, trade, or profession voluntarily petitioning for the correction of its own system with a view to public good? Was the House of Commons purged of *Borough-mongering* from within or from without? On the popular question of *Free Trade* was not every man a free-trader as applied to every business *except his own?* In Joint Stock Companies, have not twenty per cent. dividends been generally received with acclamation, and sometimes even with testimonials of gratitude? It is only when dividends fail, that the bubble bursts with high-pressure declarations of virtuous indignation, and with demands of enquiry for the detection of abuse. So much for the trading communities. Then, as to the professions of Law, Physic, and even of Divinity. Has Chancery, Lincoln's Inn, or any other corporate personification of the law petitioned for reform with a view to mitigating the legal complications and consequent public plunder connected with the transfer of land? Has any College of Physicians declared itself against continuing the dark-age use of *Dog Latin?* Has Convocation or any other corporate personification of the Church, petitioned for inquiry into the diversion from their intended purpose of Educational and Charity Trust Funds? What right or reason then, have we to expect that the Shipping Interests will voluntarily petition the legislature for an effective system of registration, throwing open the mysteries of their craft with a view to public good? What is the alternative? Is the legislature or is public association to take the initiative as the guardian of public good? If the latter, as seems to be now confessed, the Society of Arts will, doubtless, assume its proper place, and direct the attention of its 400 Associated Institutions to the registration of shipping as conducive to transport economy, which affects the rate of income-tax and the price of bread.

Now, let it be observed, how greatly tonnage ambiguity would be relieved if the capability of the ship for carrying *weight*, expressed in tons weight, were called the "Cargo Tonnage," and the capability for carrying *bulk* cargo at the conventional measurement of 40 cubic feet to the ton the "Roomage," or some other equally distinctive term. Such a registration would be commercially useful, as really expressing the capabilities of a ship for cargo, but let us see what practical difficulties would be involved in obtaining the data for such a record. It may be at once admitted that the system of admeasurement prescribed by the new merchant shipping law gives the roomage of any ship, but as the *weight* cargo would be represented by the displacement between the light draught and the load draught water lines of the ship expressed in tons weight, we are at once involved in the necessity of proposing some rule whereby some limitation of the position of the load line to which a ship may be loaded, shall be legally assigned to every registered ship, which is altogether omitted in the Merchant Shipping Act of 1854. The ship herself, when perfectly equipped for sea and ready to receive her cargo, will show her light draught line of floatation. It is the fixing of some specific limitation to the deep draught line of flotation to which a ship may be fairly loaded, that constitutes the sum, substance, and essence of the whole system of reform in tonnage registration which is now under consideration. The process of admeasurement will be a matter of routine detail, after we have once determined what are the elements which we want to measure to render registration effective.

In the Merchant Shipping Bill of 1854, the routine detail of the admeasurement of one element only—internal roomage—has been minutely elaborated; in this respect, even gnats have been strained at; but the objects which it is essential that registration should embrace with a view to practical general utility of result do not appear to have been considered; internal roomage only has been thought of; in this respect, the camel has been swallowed. Now is it, or is it not, possible to devise some prescriptive rule which may be legally recognised as assigning some limitation to the position of the regulation deep draught line of a ship. We have already seen that in 1422, by Act 9th, Henry V.; also in 1648, by Act 13th, Charles II.; also in 1694, by Act 6th, William and Mary, the deep draught of vessels was officially limited, the vessels were weighed down to such deep draught limit, and *nailed* on both sides of the stem, stern, and amidships, to denote the maximum draught and the actual weight of cargo by which the vessel would be immersed or sunk down to the deep draught mark so nailed thereon. It was only at a comparatively recent period (1720) by Act 6th, George I., that the above system of officially determining and nailing the deep draught lines of ships appears to have been superseded; and the rule adopted for determining the so called tonnage of vessels by reference to the length and breadth only, assuming that the depth would always continue (as might then have been the approved practice) to be some definite proportion of the beam, and assuming also that ships would always continue to be built of the then approved type of form. These assumptions of 1720 have not been perpetuated in Britain, as they might have been in China; but, nevertheless, the principle of tonnage admeasurement founded thereon was confirmed by various Acts, and continued in legal operation up to 1834, and since that time the same system of delusive builders' tonnage, though legally superseded in 1834, has been most tenaciously upheld, even to the present day, for, notwithstanding the new Merchant Shipping Law of 1854, legalising a totally new system of measurement based on roomage, the old law or "builders' measure," as it is emphatically called, still continues to be the base, not only of mercantile, but even of Government contract transactions in the generality of matters appertaining to the purchasing and building of ships. The old "builders' measure" was so easily applied, compared with the system prescribed by the law of 1834, that it could not be thereby rooted out, though manifestly injurious to the public. In China, the practical origin of the law and the continued operation of the law would have been equally upheld; but in Britain we subvert reason by continuing to uphold the consequence after having repudiated the cause; we deride the fixed customs of China, but in this case of tonnage we allow public interests to succumb to the convenience and habit of a class; well may even John Chinaman laugh in his loose sleeve at this half-and-half progress, and consequent self-imposed loss, of blundering, hardworking, pay-for-all John Bull; still, in 1855, the proposed reformation of limiting the capabilities of ships for cargo to any regulation position of the deep draught water line has been declared to be *impracticable.* To assert the *impossibility* of any proposed amendment as our only argument, is a refuge tantamount to an admission of the weakness of the cause thus attempted to be upheld. These are not the days to assert the impossibility of reformation as justifying the continuance of an effete practice. But as respects tonnage registration based on displacement, limited by the deep draught line of a ship, there is nothing impossible in the case; every ship demands that the loading shall cease at some limit of draught or other short of the gunwales or main deck of the ship; and is it right that the party who now determines that limit should be the party who has a direct pecuniary interest in loading the ship down to the utmost verge of floatation that his own interested decision and, therefore, possibly perverted judgment, may dictate? Even supposing it were true that it is "*impossible* to define by legislation the position of the deep draught line in a satisfactory manner," and that it must therefore be left to individual discretion, surely the person directly interested in loading a ship down to the lowest verge of risk, is the last man who ought to be entrusted with such discretionary power. But let us inquire into the practical facts of the case. The fact is, that every ship constructed on scientific principles is built with reference to some determinate limit as the constructors' deep or load draught line of the ship. Take, for example, the catalogues of vessels of which the elements of construction are given in Fincham's "History of Naval Architecture," and we find as follows:—page 248 and following pages, the constructors' "deep draught" water line given in feet and inches both forward and aft for the following list, embracing vessels of every class in the Royal Navy:—*Espiegle, Flying Fish, Mutine, Daring, Osprey, Cruiser, Sapphire, Acorn, Columbia, Wolf, Pylades, Orestes, Champion, Calliope, Vestal, Electra, Inconstant, Castor, Pique, Barham, Vernon, Raleigh, Constance, Bellerophon, Vanguard, Caledonia, Albion, Queen;* again, page 267, the "deep draught" forward and aft given in feet and inches, contrasting the French and English practice of shipbuilding for ships of 120 guns down to ships of 16 guns; pages 321 to 326, constructors' mean "deep draught" of nine ships of the Royal West India Mail Packet Company; also, of 57 merchant steamers employed in various services; and of 30 vessels of the Peninsular and Oriental and East India Companies; page 327, constructor's "deep draught" forward and aft in feet and inches of 12 celebrated yachts; pages 405 to 410, constructors' mean depth from upper part of keel to the "deep draught" water-line in feet and decimals of a foot of 115 ships and 90 steam vessels of the French Navy; and, in like manner, the records of the Admiralty, if made public, would show the "deep draught" limit forward and aft in feet and inches, for which every ship and steamer in the Royal Navy of Great Britain was originally constructed.

Such being the recorded facts of the case, let it not be said that the ostensibly marking or "nailing," or otherwise delineating the constructors' deep draught limit on the stem, stern, and amidships of ships is an impracticable requirement. The general distance of such deep draught water-line below the main deck or other line of demarcation, according to the class of vessel, may be proportionally ascertained with reference to the breadth of beam of the vessel. What, therefore, is to prevent its being legally required and prescriptively determined that the constructor's or the regulation deep draught water-line shall be ostensibly marked or delineated, and that such water line shall, in no case, be less than one-fourth, or one-fifth, or one-sixth, or other specific proportion of the beam, as may be determined, below the main deck of such vessel? This point has been thus strongly urged and illustrated by reference to vessels of every class, because the *nailing* or otherwise ostensibly delineating the *deep draught water-line,* is the one essential requirement on which any legislation for registering the weight-tonnage of ships available for cargo, must be absolutely dependent.

Presuming, therefore, that such nailing or delineation of the regulation deep draught water-line on the stem, stern, and amidships of all sea-going vessels be determined upon and enforced, we may now proceed to consider what will be the required details of registration, and by what system of actual admeasurement or approximate computation these required details of registration will be practically most attainable. This division of the subject demands consultative deliberation; and it is for the purpose of aiding such deliberations by extending the range of choice of systems, and of means for attaining the desired object, that the following views are submitted for consideration:—

It is suggested that the registration of shipping embrace the following elements, namely:—

1st. The light draught displacement in *tons weight* (A) at the rate of 35 cubic feet of such displacement to the ton, being the weight of the ship itself completely equipped ready to receive cargo; also, the corresponding internal roomage (*a*) from the floor up to the light draught area, rated at 40 feet to the ton, such being the number of cubic feet conventionally allowed in commerce as the roomage measurement of freight per nominal ton.

2d. The displacement contained between the light and the constructors' or regulation load draught lines in *tons weight*, at the rate of 35 cubic feet of such displacement to the ton, being the capability of the ship for weight-cargo, to be called the weight tonnage for cargo (B); also, the corresponding internal roomage (*b*) as contained between the light and deep draught areas, rated as before at 40 feet per nominal ton.

3d. The external measurement from the load draught up to the deck, rated at 35 cubic feet to the ton, being the surplus buoyancy (C); also, the corresponding internal roomage (*c*) between the load draught area and the deck, rated as before at 40 feet per nominal ton.

4th. The light draught displacement (A) added to the weight tonnage for cargo (B), will give the deep draught displacement (D) in tons weight; being the gross tons weight propelled from place to place at such rate of speed as may be by the power employed, whether sail or steam, which is an element of essential importance in the formula $\left(\frac{V^3 \times D^{\frac{2}{3}}}{\text{Ind. HP.}} = X\right)$ whereby the *relative* locomotive merits of ships of different sizes and *different types* of build may be comparatively classed.

5th. The sum of the three quantities $(a + b + c)$ will give the total internal roomage of the hull below deck; from which, deducting the roomage appropriated to engines and boilers, and adding the space between decks and other places available for cargo stowage, the result will be the roomage for cargo, or roomage tonnage (R) rated at 40 cubic feet to the ton.

The detail of measurement and calculations for determining the above integral elements will be hereinafter considered: for the present, it may be observed, that the above elements are, each of them, of commercial use: for example, as respects the light draught displacement in tons weight, although length, breadth, and depth from the keel up to the gunwale or main deck may be constituted as the functional dimensions for regulating the size of hull for which the builder is to be paid, still it will be generally satisfactory to the purchaser to know the absolute total weight of the material supplied, as given by the light draught displacement (A), not that such weight of material will, of itself, constitute a measure of the value of the ship, but a knowledge of such weight, conjointly with ocular inspection of the kind and quality of the material and workmanship, will materially demonstrate the substantiality of the construction of the ship, and afford a comparative indication of the money's worth received for the money paid. Nothing of the kind is afforded by the present registration record under the Merchant Shipping Law of 1854.

As regards the capability of the ship for weight cargo (B), the disappointment which constantly occurs from the nominal builders' tonnage of vessels being frequently called the "*burthen in tons*," which it is not, and erroneously regarded as the measure of the capability of a ship to carry tons weight of armament or other heavy cargo, is too notorious to need being dwelt upon; for example, see Fincham's "History of Naval Architecture," page 414, giving the builders' tonnage as the "*burthen in tons*," for all the ships of the British Navy built from the accession of Geo. I. down to the year 1850. Suffice it to say, that such mistakes and consequent miscalculations as to the capabilities of ships for mercantile transport service are commercially and nationally disastrous, and, perhaps, more than any other specific cause, conduce to mismanagement, disorganisation, pecuniary loss, and loss of life from the foundering of badly-stowed and overloaded ships. This element, viz., capability for weight cargo, is not noticed in the "Merchant Shipping Law of 1854."

As regards the internal roomage (R) available for *measurement* cargo, this element, taken *in conjunction* with the capability of the ship for *weight* cargo (B), is an important mercantile consideration, because the merchant will be able to assort his cargo in such manner that the ship shall be well filled as well as duly loaded, instead of being subject to the present irregularities of ships being sometimes deeply loaded before being filled, and at other times filled before being duly loaded. This cubical admeasurement of internal roomage is given by the Merchant Shipping Law of 1854, but it is given as an *isolated* element, without reference to the capability of the ship for *weight* cargo; and is, therefore, by itself useless for the purpose herein referred to.

As regards the deep or load-draught displacement (D), a knowledge of this element is essential to science as a means of investigating and determining the comparative locomotive merits of different types of build, and thence determining the comparative degree of *£ s. d.* economy which one type of build may possess over another under similar circumstances of transport service. This element is not embraced in the Merchant Shipping Law of 1854, and when the vast extent of commercial and national transport service of Great Britain is considered, conjointly with the superior transport economy of one type of build over another, as referred to in the paper read before this Society on the 16th May last, and more particularly set forth in Atherton's essay on "Steam-Ship Capability," 2nd edition, Table K., page 78, it cannot be doubted that this item of registration will at once bring science to bear on shipping affairs in a manner highly conducive to national interests, and from which affairs, by our present deficiencies of registration under the Merchant Shipping Bill of 1854, as amended in 1855, science is absolutely excluded from taking any prominent part. At present it is not by any recognised scientific test, but merely by opinion more or less confidently expressed, that any discrimination is made as to the relative merits of different types of form of ships, and more especially of steam-ships.

Such are the elements and objects of information which public registration undoubtedly ought to embrace. Registration ought to merit being popularly regarded as an institution working for the public good. But, on the contrary, our present registration of tonnage falsifies shipping statistics, and does not scientifically fulfil any useful object of tonnage registration other than that of being a network for the collection of imposts, and a net so defective even for that one purpose as to leave openings for all manner of evasion. Harbour dues, pilotage, and light dues are an admitted necessity in some shape or other, and registration ought not only to be a means of their equitable apportionment, but also, by aiding science, conduce to the most effective and economical carrying on of the trade from the earnings of which such imposts are to be paid.

We now come to consider the details of admeasurement for record, whereby the computation of the above-mentioned elements of registration may be determined. It is unquestionably desirable that each of the elements of registration should be correctly measured, but as the ordinary form or contour of ships does not admit of being mathematically defined, it follows that absolute mathematical precision of admeasurement by any precise formula or rule is defeated. In such cases, the well-known system called "Sterling's rule," of approximate admeasurement by ordinates, becomes usually resorted to. By this system, the more closely we desire that our admeasurement shall approximate to precision, the more numerous must be the ordinates, and the more lengthened will the operation become. For the purposes of scientific naval construction, this laborious routine of calculation is patiently performed by experienced hands. For ordinary purposes, however, of everyday life, nothing is more popularly repulsive or impracticable than long dogmatic rules for the working out of calculations of which the rationale is not understood by the generality of those concerned or employed to do the work. The consequence is, that such rules, however simple and correct in the hands of those who understand them, become repudiated for all ordinary purposes of mercantile calculation, and the old short rules, like the old tonnage law, which people have, from their youth, known by heart, and been accustomed to work by and to live by, notwithstanding that the constructive practice which originated these rules may have become obsolete, as in the case of shipping, continue, with all their errors, to be popularly acted upon and upheld.

The inveteracy of blind habit cannot be better illustrated than by the fact, that the old rule for calculating tonnage without reference either to depth of hold or draught of water, withstood the declared condemnation of several successive Parliamentary Commissions, and continued to be pertinaciously made use of to regulate ship-building contracts and the purchasing of ships in mercantile dealings, and even by government authorities, though legally superseded in 1834 by Act 5th and 6th William IV., c. 56; which thus, twenty years ago, prescribed and legalised a totally new system of tonnage admeasurement based on ordinates, as hereinbefore referred to, which system failed to be popularly adopted on account of its complication; but, nevertheless, a far more complicated extension of the same system has now been introduced by the Merchant Shipping Bill of 1854. It was not the want of accuracy that prevented the rules prescribed by the Tonnage Law of 1834 from being adopted, but the difficulty of opening up and popularising a royal road to mathematics even over the plainest ground. How then can it be expected that the more complicated extension of the same system, as legalised by the new Merchant Shipping Law of 1854 should be received. Popular education has, doubtless, of late years made great progress; but still we have scarcely arrived at such a state of proficiency as to render it advisable that our tonnage admeasurement, so constantly put in requisition by every merchant, should be the solution of the mathematical problem for the *reduction of parallelopipedons by rectangular co-ordinates.* Were the new measurement of 1854 honestly called by this its proper name, it would not be listened to for one moment; the very name would expose it; but, instead of being thus designated, it is called Sterling's simple and easy system of admeasurement. Undoubtedly, Sterling's reduction of parallelopipedons by rectangular co-ordinates, like the calculation of eclipses, may be simple and easy to those who perfectly understand it, but a mystery to those who do not, and very likely to be bungled by those who attempt to apply it in ignorance of the principles involved. It being, moreover, now found by experience, that the new law of tonnage admeasurement is not generally and popularly applicable, and that the old and popular rule for calculating tonnage cannot be outrooted, unless some other rule, equally simple in its application and obviously intelligible, be substituted in its place, it may be well to examine whether, by doing away with the fundamental error of the old rule, namely, the substitution of half the breadth of beam for the depth, and thus taking cognisance of all the three dimensions, length, breadth, and depth, both externally and internally, we may be able to obtain data for satisfactorily calculating the elements before mentioned as necessary for useful registration. With this view, it is proposed that the following particulars and detail of ship's admeasurements be officially taken by authorised measurers and recorded in Tabular Form.

By the following scheme of detail dimensions, it is obviously intended to obtain the circumscribing cubical admeasurement, or product of length, breadth, and depth of different portions of the vessel taken separately; for instance, firstly, of that portion of the vessel, both externally (A) and internally (*a*) below the light draught water line area, secondly, of that portion of the vessel, both externally (B) and internally (*b*) which is contained between the light and the constructors' or regulation deep-draught water line areas, and thirdly, of that portion of the vessel that is contained externally (C) and internally (*c*) between the deep draught area and the deck of the vessel. The cubical product of the circumscribing dimensions of length, breadth, and depth, being thus taken, both externally and internally for each of the three portions of the vessel, we shall be able to deduce approximately the contents of any new ship from the known proportional contents of ships of similar type of form with reference to their corresponding circumscribing dimensions of length, breadth, and depth.

TABLE OF DETAILS FOR RECORD.

Name of vessel.		
Year when launched.		
Year when measured for registration.		
Distance from keel to light draught.		Midship Depths.
Distance from light to deep draught.		
Distance from deep draught to deck.		
Length	At light draught	External Dimensions.
Breadth		
Length	At deep draught	
Breadth		
Length	At main deck	
Breadth		
Length	At light draught	Internal Dimensions.
Breadth		
Length	At deep draught	
Breadth		
Length	At main deck	
Breadth		
Distance from floor to light draught.		
Distance from floor to underside of deck.		
Length	Deductions from roomage of spaces not available for the use of passengers or stowage of cargo.	
Breadth		
Depth		
Length	Addition to roomage of covered in spaces above the main deck available for the use of passengers or stowage of cargo.	
Breadth		
Depth		
Engine power, with reference to some regulation unit.		
Total area of the fire-grates		
Character of the lines of the vessel—whether very full, full, medium, fine, or very fine.		

Thus, it is proposed that the lower portion of the ship, namely, the portion from the keel up to the light draught area, be, in the first place, approximately obtained by taking such proportion of its circumscribing product of length, breadth, and depth, as is known from experience to be the measure of bottoms of medium type of build, as respects the character of the fore and aft lines and the rise of floor, but again correcting this primary approximation by adding or subtracting a certain percentage, as the peculiar character of the lines of the ship to be measured may be comparatively full or hollow, and the floor comparatively flat or rising. For example, it is known that a ship must be very full, or what is called burthensome, for this lower portion of the bottom up to the light draught area to be 50-100ths of the circumscribing product of length, breadth, and depth, and that in a very fine bottomed ship, with unusually rising floor and hollow lines, it may be as little as 30-100ths; therefore, taking the mean of these extreme proportions, namely, 40-100ths of the circumscribing product of length, breadth, and depth as the approximate admeasurement of the ship up to the light draught area, the result will probably be within 10 per cent. of the correct measure, and the internal roomage up to the light draught area may be taken in the same manner, namely at 40-100ths of the circumscribing product of the internal length, breadth, and depth.

Again, it is known that the constructive form of a ship must be very full, carrying the body of the ship well forward and aft, if the light and deep draught areas of the vessel come up to 85-100ths of the circumscribing rectangular product of length and breadth, and that in a fine built ship it may be 65-100ths. In order, therefore, to obtain approximately the measure of that portion of the vessel which is contained between the light and deep draught areas, we may multiply the mean length of these areas by the mean midship breadth, take 75-100ths of the product for the area of the mean horizontal section between the light and deep draught lines, and multiply by the distance between the light and load draught lines; the result will probably be within 10 per cent. of the correct measure of this portion of the ship, between the light and load draught lines representing the displacement available for weight cargo; and the internal roomage between the light and the load draught areas may be taken in the same manner by taking 75-100ths of the product of the mean internal dimensions of length and breadth at the light and load draught lines multiplied by the distance between them.

Again, to measure the space between the deep draught area and the deck, multiply the mean length by the mean midship breadth; take, as before, 75-100ths of the product for the mean area, which multiply by the distance between the deep draught area and the deck, and the result will be within 10 per cent. of the correct measure of this portion of the ship both internally and externally. Thus, instead of our liability to error being absolutely unlimited, as is the case with the old rule of builders' measurement, in which no direct cognizance was taken of *depth*, we have now, by conventional approximation, reduced the limit of error down to 10 per cent.; and this extreme error may be again approximately corrected by some per centage, say 5 per cent., or 10 per cent. being added to or deducted from each of the foregoing results, according as the recorded character of the lines of the ship, may be full or very full, hollow or very hollow, as compared with lines of medium character, on which the foregoing approximate results have been based. By this arbitrary correction of the primary approximation, based on the character of the lines, it is probable that the result of the computation would be within 2½ per cent. of that which would be obtained by the system of admeasurement by ordinates; such as that originally legalised in 1834; and subsequently rendered more elaborate by the Merchant Shipping Bill of 1854, now in force. It is acknowledged that these proposed rules, based on the actual admeasurement of the circumscribing product of length, breadth, and depth, corrected in the first place by conventional approximation to the general medium form of ships; and, secondly, again corrected by reference to the peculiar character of the lines of the ship to be measured, do not present a purely scientific system of admeasurement; they give merely an arbitrary approximation, the result being probably within 2½ per cent. of actual precision, and, therefore, practically answering the intended purpose; but, nevertheless, the detail of admeasurements for this proposed system, being merely the length and midship breadth at the light draught and at the deep draught, and at the deck, and the respective depths between those areas, are so analogous to the admeasurement under the old rule of builders measurement, that it is conceived there will be no difficulty in filling up the tabular record of data as given in the foregoing form, and thence working out the results of light draught displacement (A), weight tonnage for cargo (B), internal roomage (R), and regulation deep draught displacement (D), of any ship; each and all of which results are indispensable for rendering the registration of shipping a legislative protection over property and life, a record of mercantile value in connection with the conveyance of cargo, and enabling science to give its aid in estimating, from the actual performance of ships, the relative degrees of merit between ships of different types, and thus promoting £ s. d. economy in the commercial transport service of Great Britain, amounting, it is said, to about twelve millions of tons weight per annum. It is also to be observed that the details of admeasurement hereby proposed do not embrace the objectionable and inquisitorial system of taking off the builders' lines of a ship as is done by the admeasurements under the Merchant Shipping Law of 1854. The objection as to taking off the builders' lines may also be urged on the part of builders against any system for correctly taking off the horizontal areas or sections, and also against the system of measurement by means of a curve of vertical sections, which system is understood to have been originally suggested, and practically applied in the year 1829 by Mr. James Peake, a shipwright officer in her Majesty's service, and is certainly a system readily applied, and capable of giving even more correct results than are obtained by Sterling's rule; but though admirably adapted for prosecuting the calculations of a ship constructor, it may not be conveniently available for ordinary use, as it involves the necessity of laying down lines to a scale, which art, though easily acquired, is not commonly understood. In fact, Mr. Peake's system of aggregating the measurements by means of a curve of sections, is said to be the system now adopted for verifying the results of the admeasurements taken under the Merchant Shipping Bill of 1854.

We now come to consider what dimensions, or combination of dimensions, may best constitute the builders' measurement, in lieu of the old law, still in use, though legally repealed since 1834. In the first place, as the capability of the ship for weight cargo (B) has not any definite or constant ratio to the gross size of the ship for which the builder must be paid, it cannot be taken as a measure of the builders' tonnage, nor would the size of the ship be fairly represented by the internal roomage $(a + b + c)$ irrespective of external dimensions. Strictly, the light load displacement, giving the actual weight of the ship, is the most correct integral indication of quantity of material delivered under the builders' contract. Ships, like marine boilers, may, if so agreed upon, be built by the ton *weight*, the price per ton weight varying according to specification of materials and workmanship; but, in fact, though ships were to be paid for by weight, it would still, as in the case of boilers, be requisite that some determinate *size* be stipulated for as the base of the contract, to be called, according to custom, the "builders' measurement." The true measure of this quantity would be the external bulk of the ship, less the internal capacity; but a rule based on these elements would not answer a merchant's purpose as conveying any idea of the size of the ship to be built. It is, therefore, submitted that the builders' measurement be determined by taking the product of the external length and breadth as measured at the regulation deep draught water line multiplied by the internal depth of hold, and divided by 100. This result to be corrected as before stated (if so thought necessary) according as the intended ship may be proposed to be built with full lines burthensome for cargo, or finer lines more adapted for speed. This proposed rule for determining what may be called the "Builders' Measurement," is almost identical with the French rule for determining tonnage. It is also to be observed that this rule embraces the two dimensions, length and breadth, whereby alone the builders' tonnage has hitherto been calculated by the old law, and it also embraces the *depth of hold* whereby, conjointly with external length and breadth, merchants are accustomed to form an idea of the size of ships. It is also suggested that this Builders' measurement be registered and continued as indicating the size of the ship on which harbour dues, pilotage, light dues, and the like are to be assessed.

Finally, the question remains whether or not, in charging harbour dues, pilotage, and the like, any allowance be made in the case of steam-ships for the space taken up by the machinery and not available for cargo. In considering this question, it may be important to bear in mind that the imposts in question are charges necessarily made in consideration of *accommodation* or *services* actually rendered, and which are greater or less according to the gross size of the ship, and are entirely irrespective of the kind, quality, or value of the cargo which the ship may hold. If, however, the roomage for cargo is to be made the subject of discrimination between sailing ships and steamers, as was originally enforced by the law of 1819, and continued by the new merchant shipping law of 1854, why should not the *value* of the cargo be taken into account for assessing these imposts as well as the mere bulk thereof. Should this be done, it is probable that the average *value* of the cargo of steam-ships, though small in quantity with reference to their gross tonnage, would be found as great as the *value* of the cargo of sailing vessels, though large in quantity with reference to their gross tonnage. But, further, this Merchant Shipping Bill of 1854, notwithstanding the amendment thereof of 1855, curiously shows the endless task of legislative discriminations; for example, by clause 23 (*a*) one scale of tonnage deduction is prescribed for vessels propelled by paddle-wheels, and another scale of deduction for vessels propelled by the screw, but no provision has been made for the paddle-wheel and the screw being both combined in the same ship, as in the great leviathan now in progress of construction for the Eastern Steam Navigation Company; nor, on the other hand, has any provision been made for the case in which the mode of propulsion is neither the paddle nor the screw, as in the North Fishery steam-vessel *Enterprise*, which is propelled by a jet. It may be observed, that the benefits incidental to steam navigation ought to meet the disadvantages which may be incidental to that system, without reference to discriminating systems of tonnage admeasurement, favouring one system of shipping to the disadvantage of another. This remnant of pampering protection is surely injurious to the health of commerce, and though consonant with the spirit of the times in 1819, when this discrimination between steaming and sailing originated, it is not consonant with the principles of commerce now adopted in 1856. These, however, are mercantile, rather than professional considerations.

It is, therefore, submitted for the consideration of the Society of Arts that the official survey of shipping should embrace the various details herein-before referred to and specified in tabular form; also, that port records be taken of the draught of water at which all ships leave PORT, showing the deficiency or excess as compared with the regulation deep draught line; and that the officially published records of shipping registration, such for example as that in the merchant navy list, shall embrace the following points: 1st. The *Builders' Measurement;* 2d. The displacement in tons weight available for cargo, or the *cargo tonnage;* 3d. The nett roomage available for cargo, or the *cargo roomage;* 4th. The deep draught *displacement* of the ship, calculated to the regulation deep draught line; and 5th. The horse-power of steamers calculated with reference to some definite and legalised unit, and to be called the "Marine Horse Power." It is submitted that such registration would fulfil the requirements of public good, of commerce, and of science; and, in respect to humanity, the prevention of a wreck being better than the saving of a crew, it is submitted, without disparagement of life boats, that the most effectual of all institutions for the protection of life and property from shipwreck, would be *effective* REGISTRATION.

DISCUSSION.

Mr. MOORSOM (Inspector-General for Tonnage to the Board of Customs), in a note to the Secretary, says his "official duties are so onerous at the present time, besides a great infirmity of hearing, as to entirely preclude him from turning his attention to scientific colloquial discussions." He, however, observes, "that the burden of Mr. Atherton's condemnatory harangue of the existing law of measurement, is on the absence of its having expressed the dead-weight which a ship is enabled to carry. Now, shipbuilders, shipowners, and the highest authorities connected with maritime affairs have set little value on this, Mr. Atherton's desideratum, so long as the true internal cubical capacity is made the basis of the fiscal law. This latter has been faithfully effected, as avowed by Mr. Atherton himself, though in the more concentrated form of 100 feet to the ton, instead of 40 feet to the ton, which Mr. Atherton would have preferred. It is, however, intended to reduce it to the 40 feet, and show it on the ship's register, for the purpose of greater commercial convenience, retaining at the same time all the present advantages (which are many) of the existing legal standard for the assessment of light and other dues. And as regards the dead-weight a ship is enabled to carry, which is also contemplated to be placed on the register, it can be ascertained as correctly, if not more so, from the present cubical tonnage, as it possibly can be from Mr. Atherton's empirical load and light floatations, the positions of which the highest and most intelligent authorities in this country have pronounced as impossible of satisfactory attainment. I have, therefore, only further to observe that, as the dead-weight proper to be carried by a ship is confessedly, on the part of Mr. Atherton, "the sum, substance, and essence of the whole system of reform in tonnage registration" he seeks for, and as it is attainable on quite as legitimate grounds by the legal means at hand as by further legislative enactment, the present agitation against the law, before even its first operations can be fairly judged of, is, I submit to the judgment of all liberal minded men, an unnecessary and premature proceeding. In conclusion, in order that the system may not appear so abortive as pronounced by Mr. Atherton, I have to state that already, in the first eight months of its operation, above 2,000 ships have been *re*-measured under it by their owners' application; and further, beg to add the following testimony of Mr. Gilmour, who is the owner of 30,000 tons of shipping—the largest private ship-owner in the world—and of Messrs. W. S. Lindsay and Co., owners of 20,000 tons, and second only as private ship-owners in importance to Mr. Gilmour. Mr. Gilmour's testimony is contained in a letter of the 4th instant, written on the occasion of his being informed that a party had publicly stated he, Mr. Gilmour, had condemned the new system. Mr. Gilmour says, 'I am exceedingly astonished at Mr. ——'s conduct. I told him candidly I could not approve of his mixed mode of measurement, and that the mode of measurement now in use was as true and as perfect as could possibly be, and that I had no doubt it would remain the law of the land for many generations; that I had not met *one* man who has a word to say against the mode of measurement, but all those not interested in steamers complain bitterly of the allowance for the engine-room, and even some of the steam-boat owners admit it is too much.' Messrs. W. S. Lindsay and Co., in their circular list of freights, dated Jan. 1st, 1856, say:—'The new law of tonnage admeasurement, which came into operation on the 1st of May last, appears to have fully realised the anticipations of all who were favourable to its introduction. We have before us the register tonnage of 1,100 ships, measured since that date, under the new Act, and their register tonnage under the late Act, and considering that the principle of admeasurement was entirely changed, it is remarkable that the difference in the measurements is so small. These 1,100 ships under the late law, measured 248,842 tons, and under the present Act they measure 231,277 tons, showing only a difference of 7 per cent. (decrease) between the new and late law. The principle of the new law is to take the cubical contents of the ship's hold, and all enclosed spaces for cargo and passengers, and upon that base the register tonnage, so that ship-owners can now build vessels of any models they please, without being subjected to an extra tax, as they were in many cases under the late law, when they constructed vessels of the most approved forms for speed and safety. That the new law will answer all the objects its promoters had in view, there cannot now be a doubt. The accuracy, too, with which vessels are measured under it, and the check upon error or fraud in the admeasurements are worthy of notice. Competition with other countries has done much, very much of late, to improve the model and mode of construction of British ships, and this new law leaving owners as it does, free to construct their vessels on the most approved lines, is aiding in a remarkable manner the rapid progress (commencing with the repeal of our Navigation Laws) which these vessels have made of late years. The contrast between the vessels recently built and those launched only five years ago is indeed striking.' "

The Chairman said, as two such high authorities as Mr. Gilmour and Messrs. Lindsay and Co. had been quoted in favour of the existing law of registration, it was highly desirable to have some remarks from gentlemen connected with the shipping interest; and, as he saw Mr. Scott Russell present, who was both a shipbuilder and shipowner, he would request him to make a few remarks.

Mr. Scott Russell said, before he made any observations on the subject, he would ask Mr. Atherton what his idea was as to the possibility of finding a loadwater line, and as to the means which appeared to be within reach for determining it.

Mr. Atherton would suggest that some limitation should be prescribed—for instance, supposing a ship to have a thirty feet beam, then the deep-draught water-line might be fixed at a certain proportion of the beam—say a fourth, a fifth, or a sixth, below the main deck. This, however, would be a matter for serious consultative deliberation, but something on that principle was what he would suggest—and, as in Mr. Fincham's "Treatise on Naval Architecture," the deep draught water-line of some thousands of ships was given, that would be a useful book of reference to see the general averages.

Mr. Scott Russell quite agreed that there existed an immersion of ships, beyond which any further loading became dangerous, and, therefore, that it was desirable to fix what that illegal over-loading was. The gunwale of a ship might be allowed to come within either a fixed dimension in feet from the water, or a given proportion of the beam from the water. With reference to the proposal of Mr. Atherton that a much fuller return should be furnished in regard to every new ship, he agreed with him in thinking that such a course was most desirable, and it could not be objected to on the part of shipowners. All the additional particulars enumerated by Mr. Atherton should be obtained by government, and should, in some shape or other, be placed at the disposal of the public, and he apprehended that the present board of measurement at the Customs would be very willing to avail themselves of the organisation which exists in order to carry out that object. In regard to the suggestion for the registration of the light water draught of every vessel, or, he might say, the light displacement, it was a very practical one, because the vessel on leaving the builder's yard might have on board a full equipment, and then her displacements and draughts of water at both ends might be easily and usefully registered. That would form, in some degree, a registry of the money spent on the ship, but not of the value of the ship, or her quality. In iron ships it would not show the advantageous disposition of the materials as regards strength. As a shipbuilder, and shipowner, he should not have the least objection that both these should be required. He then came to the next point, which was an essential one. If they granted that there should be a load water-line and a light water-line, and a light water displacement when the vessel was delivered over to the owner by the builder with a clean-swept hold—then Mr. Atherton had got all he wanted, because if they then took the measure of the displacement of the ship when full, by calculation, and if they had her displacement when she had merely her own weight to carry, the difference between those two was actually the load tonnage capacity of the ship which Mr. Atherton wanted to obtain, and that would show exactly the number of tons of dead weight, independent of roomage, thus giving a really absolute measurement of the total tons of dead weight a ship would carry. He considered it most desirable, both for shipbuilders and shipowners, to know the exact tonnage capacity of a ship. There was one thing which he objected to in a financial point of view —namely, the altering the registered tonnage of a ship in any way—that is to say, the bringing down the 100 cubic feet by which the nominal tonnage was now divided to 40 feet, because they could not control the fiscal regulations of other countries. If in this country they were to adopt a system of real dead weight tonnage, or anything more approaching to the truth than the fiction on which they now charged register tonnage, they would immediately put a very heavy tax upon the shipowner. At present they, in this country, were as honest as they could afford to be; and, if they did not get other countries to adopt a similar system, they would have to resort to what Mr. Moorsom said in his letter—namely, to have two tonnages written upon their ships.

Mr. Atherton said, it would be observed in the paper that he proposed the builders' measurement should continue as at present, and be determined according to the French mode. When he alluded to the registration of what a ship would carry, and also the roomage, that was merely additional information to be placed on the records of the Board of Trade for the information of the public.

Mr. Scott Russell entirely agreed in the desirability of having the roomage tonnage registered, as also the absolute dead-weight tonnage. What, then, should be stamped upon the ship herself, in relation to ships of other countries, had better remain a matter of mere fiscal regulation. He had no objection to the register tonnage being taken arbitrarily from the length and breadth—the depth of the hold being taken as an element. As far as the buying and selling of ships, the plan proposed, or something like it, would be an advantage, and a more honest plan, perhaps, than the present. He thought that shipowners, in buying ships, were continually deceived; they bought a ship which they were told was so many hundred tons, and a second explanation had to be made. He had for many years gone on the opposite principle—that of building ships for his customers merely with reference to what they would carry and what they would cost. He found it much better for both parties—it prevented misunderstandings; the builder gave his customer exactly what he wanted; the real interest of the customer was promoted; and, as a necessary consequence, in the long run, the interests of the builder himself. His plan was, instead of the usual plan of building by register tonnage, to ascertain the number of tons of goods required to be carried; the room required for light cargo, and the number of knots per hour which the vessel should be able to sail; and, having done this, he proceeded to calculate and settle the price at which a ship could be built to perform the necessary conditions, in a good and seaworthy manner. According to his experience, this plan had worked well, and was beneficial to both shipowners and shipbuilders. He was not sure that the present mode of measurement was not a very fair one, for fiscal purposes. He, to a certain extent, took the side of Mr. Moorsom on the subject—he thought that the measurement of Mr. Moorsom had been planned with a view to obtain some of the advantages they had all along been contending for, namely, allowing the builder a tolerable latitude in the shape of his ship, without injuring him in reference to the fiscal charges of the vessel, which to a certain point was still done; therefore, he would say, better let the nominal fiscal tonnage remain as it is, and add to it all the information proposed to be obtained by Mr. Atherton, than be immediately changing it again for certain minor advantages. As far as he had seen of the present law of tonnage it worked tolerably well, and adjusted the fiscal taxation to the average earning power of the ship. In conclusion he would observe, that the addition of all the information asked for by Mr. Atherton, would be a great boon to the shipbuilding and shipowning public, and that it would be of great advantage if the existing organization for the measurement of tonnage were used for obtaining the additional information, and he did not think government interference would be more acceptable in anything connected with mercantile interests than when it was used for the purpose of obtaining correct statistical information.

Mr. Pearsall inquired whether there was not an essential difference between the buoyancy of deep sea-water, and the water of our rivers, so much so, indeed, as to allow a ship to sink materially when she came into the latter, and thus have a tendency to endanger the ship.

Mr. **SCOTT RUSSELL** stated that the difference existed but to a comparatively small extent. The difference between the floatation of a very large ship, indeed in salt and fresh water, would not amount to six inches.

Mr. **ATHERTON** said, the deep draught water line might always have reference to sea-water.

Mr. **ANDREW HENDERSON** concurred in the views so ably expressed by Mr. Atherton. He had listened with much interest to the historical sketch of the progress of tonnage measurement, and the lucid explanation of his views given by Mr. Scott Russell, the fair reasoning and practical application of which contrasted most favourably with the tone of Mr. Moorsom's letter just read, in which, while again declining scientific discussion, he designated his opponent's views as a "condemnatory harangue" and an agitation against the law. Mr. Atherton had rightly observed that the question now raised was one of PRINCIPLE, as to whether the internal space or roomage of vessels was to be the basis of all public record of the capabilities for payment of fiscal dues, or whether tonnage registration was to comprise an external or displacement measurement defining the weight of cargo capable of being carried with safety, as well as information of commercial utility and locomotive capability. His own opinion was, that by carefully investigating the advantages of both modes of measurement, they might be combined; but, unfortunately, there was much difference of opinion both as to the mode and principle of measurement, as well as to the object of registration. He would remind the Society that at their meeting on the 16th of May last, Mr. Scott Russell explained the anomalies that had arisen by the then new mode of measurement under the Merchant Shipping Act of 1854. He (Mr. Henderson) having visited Liverpool, the Clyde, and other ports, found a very strong feeling against the reduction allowed to steamers in the register of their tonnage as compared with sailing ships. Knowing this, he was not a little surprised to find that Messrs. W. S. Lindsay and Co., in their circular of the 1st of January last, stated that "The new law of tonnage admeasurement, which came into operation on the 1st May last, appears to have fully realised the anticipations of all who were favourable to its introduction;" and that the register tonnage of 1,100 ships, measured since that date, under the new act, and their register tonnage under the late act, showed so small a difference, as only 7 per cent. decrease—which, considering the principle of admeasurement was entirely changed, was remarkable. He alluded to the statements in this circular as showing one of the difficulties in the way of reform in such matters, for the statements were erroneous in all points except as to the amount of reduction of 7 per cent. in the general tonnage, for, so far from the principle being entirely changed, the new act was based on the internal measurement that had been in operation since 1834, while in principle, the old, or builders' tonnage, was an external measurement. The first Committee of 1821 reported in favour of a change to internal measurement. This was not carried out. However, the proposal, along with nine others, was brought before the Tonnage Committee of 1833. Of the nine propositions, three were for internal measurement, viz.; those by Mr. Palmer, Mr. Riddle and Lieut. Raper; and six proposed external measurement, including those by Messrs. Hookey, Carter, and Davis Gilbert. Mr. Wood, of Port Glasgow, suggested the measurement of eight sections, by which he had built and sold ships. Mr. Parsons, a naval architect, proposed a rule for the displacement-measuring of the hull as the basis of tonnage, the computation being facilitated by the use of diagrams, sections, and curves of areas, as recommended by Mr. Peake. The Committee reported in favour of the internal measurement, as adopted in the Act of 1834, and subsequently modified. The Commission of 1849 was appointed to inquire "into the defects of measuring ships for tonnage and to frame a more perfect rule." The Commission comprised Lord John Hay and two nautical gentlemen, the representatives of shipowners, insurers, shipbuilders, and five surveyors and naval architects. It reported that the equitable basis on which charges and dues should be made, was the entire cubic contents measured externally. It framed two rules, which were embodied in the Bill of 1850. A proposition was then made by Mr. Moorsom to substitute, for the principle agreed upon by the commission, an internal measurement differing but in name from that which had been found imperfect since 1834. After some delay, this became law in 1854, and came into operation on the 1st of May, 1855. In other words, the principle was abandoned, on the assumption that the difficulty in the detail effecting the measurements were insuperable. The working of the new act he found to be as follows:—That the whole establishment was a branch of the Custom-house, having a surveyor-general of tonnage in London, and a surveyor at one outport. He had ascertained, from inquiries at the outports, that the Custom-house measurers found great difficulty in obtaining a correct mensuration in the tabular formula to be forwarded to the surveyor-general. From this copy, furnished by the builder, it would be seen that the rule prescribed that the sections should be taken at exactly equal distances of the length, and the measured breadths at four or six exactly equal distances of the depth of hold to the decimal part of an inch, these intervals being used as the multiple for computing the cubic contents of hold and tonnage. Any error in the height or distances measured must render inaccurate the whole calculation, while the fixtures in the hold of ships and steamers, of masts, engines, &c., rendered it often impossible to take the measurements at the proper places. This difficulty had led some of the measurers to form diagrams of the sections by a curve run through the measured breadths; this at once showed erroneous ones, which could be remeasured and corrected before the tonnage was calculated, and thus prevent a wrong registration. Instead of this the new rules oblige the measurers at every port in the kingdom to send a copy of this printed formula to Mr. Moorsom, the registrar-general at the Custom-house, London, where it was stated he could form *detective curves* to ascertain if any attempt had been made to *evade the fiscal dues* by incorrect measurement. If error was discovered in London, it became necessary to send to the distant port for correction, and, should the ship have sailed in the meantime, it rendered her remeasurement on return necessary, which delay and expense would have been prevented if the diagrams and curves had been formed at the time of measurement by the local surveyor and the builder or owner.

Mr. **MITCHELL** said, without entering into the merits of the two modes of admeasurement so ably set forth by Mr. Atherton, and so clearly explained by Mr. Scott Russell, there were one or two statements made use of by Mr. Atherton, to illustrate what he considered to be the evils of the present system of tonnage admeasurement, which, he thought, required notice, because they appeared to him to be unjust towards the legislature as well as the British shipowner, and not sufficiently exact to go forth to the public as admitted facts. Mr. Atherton alleged that, whilst every care was taken by the legislature to guard against accidents and loss of life on railways, by strict supervision on the part of the government, no notice whatever was taken of the loss of life at sea by reason of the unseaworthiness of ships, through being over-loaded or otherwise. Now it should be known to the public that, in the Merchant Shipping Act of 1854, which had been so frequently referred to by Mr. Atherton in his able paper, there were stringent provisions in regard to the seaworthiness of ships, and very heavy penalties were inflicted on the shipowner, in the event of loss of life at sea through unseaworthiness, from whatever cause it might arise. He thought, therefore, that it was proper the public should know that they were thus cared for and protected when travelling in British ships, as well as they were by that supervision on railways so warmly commended by Mr. Atherton. There was another point referred to by Mr. Atherton which, in justice to the shipowner, was also deserving of notice. It was inferred in one part of the paper read that night, that British shipowners were interested in the present mode of admeasurement, because it was difficult to comprehend, and deceptive, and that in fact they were opposed to any further legislation on the subject from fear of exposing the "mysteries of their craft." But if the system advocated by Mr. Atherton could be introduced, the public, we were told, (but in what way he was at a loss to discover) might fairly calculate upon a reduction of the present "rate of income tax and the price of bread." He feared, however, that if we were induced to expect to effect these desirable objects by an alteration in the mode of admeasurement of our ships, we should greatly deceive ourselves. But in this case also the public were sufficiently cared for and protected by the legislature, because, if they were liable to imposition by the present mode of measuring British ships (which he could not believe), they were at perfect liberty, since the repeal of the navigation laws, to employ foreign ships, which were not subject to this alleged objectionable admeasurement. He mentioned this fact to show that there was no law to enforce the employment of British ships, which were said to be so improperly represented to the public—through the "mysteries of the craft"—in the present mode of admeasurement; but he did not think that our merchants and travellers by sea availed themselves of this option to an extent that would tend to justify the charge of deception brought against British shipowners by Mr. Atherton; hence the statement of Mr. Atherton, in this respect, appeared to him not only inapplicable but without foundation in fact. He had felt it his duty to make these observations, in order that the public might not be misinformed on matters of such vital importance, and that the British shipowner might be fairly represented in connection with the interesting subject so ably treated by Mr. Atherton.

Mr. Atherton replied that, although the Mercantile Shipping Act of 1854 had imposed penalties in cases of proved neglect in shipwreck, it had done nothing to prevent the causes of shipwreck. Mr. Mitchell had misapprehended the drift of his arguments in reference to the proceedings of the shipping interests. He (Mr. Atherton) argued that if science were brought to bear, as it ought to be, and would be by the aid of effective registration, on shipping construction, the result would be an improved type of build, highly conducive to economy in the conveyance of goods.

Sir John Rennie said the Society was greatly indebted to Mr. Atherton for bringing forward such an important subject as the one which had been under consideration that evening. When they came to consider what a contrariety of opinions there were as to the mode of ascertaining what the capacity of a ship really was, they would agree that it was a source of great discredit to this country. In conclusion, he had much pleasure in moving a vote of thanks to Mr. Atherton for his able paper.

The Chairman said every member of the Society would join in cordially thanking Mr. Atherton for his paper, from which they would gather that what he proposed would be an additional security to navigation, and be of immense benefit to this country generally. They learnt from the observations which had been made, that by registering the load water line and the light draught line, they would have the means of ascertaining the amount of tonnage which was available either for dead weight, as sailors would term it, or for cargoes the specific gravity of which was lighter than water. Great results would follow if the suggestions of Mr. Atherton were adopted, and he had much pleasure therefore in putting the vote of thanks.

Mr. Atherton said, that it was gratifying to him that the paper which he had been permitted to read that evening had produced the effect of eliciting from gentlemen eminently qualified to judge of the national importance of statistical shipping registration, the expression of their opinions as to the necessity for the introduction of an improved system of tonnage registration, and of their views as to the practical proceedings most likely to conduce to the attainment of the desired object. The British Association, impressed with the desirableness of inquiry into the subject of tonnage registration, had appointed a committee for this purpose, and one of the objects with which he had brought this question before the Society of Arts, had been to submit for public review an exposition of the *technicalities* of the subject, elicit the opinions of others, and thus become instrumental in collecting information and setting forth a statement of the case that might assist the committee of the Association in the prosecution of their labours, and perhaps be deemed worthy of consideration, even in official quarters, whence legislation in all proved cases of the requirements of public good might be expected to emanate. The opening up and expansion of this question, not its restriction to his own or to any other particular set of views, had been his object on the present occasion. He therefore thanked the gentlemen who, in responding to this call, had thrown additional light on the subject by the expositions which they had that evening announced; and in concluding this discussion he begged to nail upon the mast, under which we were sailing in the loyal prosecution of this good cause, the declaration that tonnage registration, the base of maritime discipline, ought not to continue, as it now was, a delusion as to the mercantile statistics of the country, not affording data for meeting the requirements of commerce, or of science, or of humanity, but it ought to be a statistical record of fact, affording official data valuable to commerce, instructive to science, and promotive of humanity;—valuable to commerce as enabling merchants, and if need be, the government, to apportion the amount and kind of shipping to the amount and kind of their transport requirements;—instructive to science, as aiding its devotees in their patriotic labour of discriminating, on scientific principles, what types of form in ship-building are most conducive to locomotive efficiency, resulting in economy of goods conveyance; and promotive of humanity, as affording the means of investigating the causes under which in the course of a single year no less than 1,799 vessels have been wrecked at sea, as appeared by the *Shipping Gazette* to have been the case during the past year of 1855, and preventing the recurrence of such causes for the future. He begged to express his thanks to the meeting and to the chairman for their favourable reception of the paper, by which he had thus endeavoured to bring the question of tonnage registration before the notice of the Society of Arts and of the public.

On the motion of Mr. Henderson, seconded by Sir John Rennie, a vote of thanks was passed to the chairman, which having been acknowledged,

The Secretary announced that the Paper to be read at the meeting of Wednesday next, the 23rd inst., was "On the Manufactures of Price's Patent Candle Company," by Mr. G. F. Wilson, F.R.S. On this evening Dr. Lyon Playfair, C.B., F.R.S., will preside.

EIGHTH ANNUAL EXHIBITION OF INVENTIONS.

The following circular has just been issued to all patentees and others:—

Society for the Encouragement of Arts, Manufactures, and Commerce, Adelphi, London, Jan. 17, 1856.

Sir,—In the year 1847, the then Council of this Society felt that, in the absence of a permanent Museum of

Inventions, it would be beneficial to collect annually for public examination, for a limited period, as many specimens, models, drawings, and descriptions of recent inventions, whether patented, registered or not, as it was possible to obtain the loan of. Succeeding councils have taken the same view; and I am desired to inform you that it is intended to open the Eighth Annual Exhibition of Inventions on Easter Monday, the 24th of March next.

If you propose being a contributor, it is necessary that you should *communicate with me forthwith*, stating, 1st. The title of your invention. 2nd. Whether the article to be exhibited will be a specimen, model, or drawing.

The articles must be forwarded to the house of the Society *carriage paid*. The days fixed for their reception are Thursday the 6th, Friday the 7th, and Saturday the 8th of March.

All articles should be accompanied with a brief description of the invention, a wood-block (where possible), and a reference to any publication where a fuller account may be found. I enclose for your guidance a specimen page from the last catalogue.

I beg to add that no charge whatever is made for space, and that the Exhibition is open free.

I am, Sir, your obedient servant,
P. LE NEVE FOSTER, Secretary.

LOCAL SUB-UNIONS.

Mr. John Banks, the Honorary Secretary to the Hastings Mechanics' Institution, writing in a local paper in reference to the proposed meeting, on the 18th instant, of representatives of the metropolitan and other Institutions, says:—

"It may be asked, 'How is it, if annual conferences are held, that this meeting is deemed necessary?' 'How comes it that, though the Union has existed now between three and four years, so little practical effect has resulted as to require an extra meeting for the consideration of the very subjects which have formed part of the agendas at the various conferences?' I believe the fault lies with the Institutions themselves. I will leave the subject of classes for a future communication, and will confine myself, in this letter, to lectures. I have attended every conference hitherto, as the representative of the Hastings Mechanics' Institution, and it has always struck me that, for the lecture department to be improved by means of the Union, Institutions must exert themselves much more than they have hitherto done for that purpose. The Society has annually published a List of Lecturers, recommended by different Institutions, and this list has been circulated extensively among the Institutions in Union, but I question very much if any practical good has resulted therefrom—and simply for this reason, no combination exists among local Institutions for the purpose of giving effect to the lecture department. One Institution may probably engage a recommended lecturer from a distance, but the lecturer, coming, perhaps, from London for a single engagement, comes at his maximum charge, and, of course, the funds of the Institution suffer in consequence. Local unions are wanted, and then, doubtless, first-rate lecturers might be obtained at a reasonable rate. This South-Eastern corner of England (Kent and Sussex) is admirably situated for the purpose of carrying out such an arrangement. There are Institutions at Tunbridge Wells, Margate, Dover, Folkestone, Ashford, Canterbury, Maidstone, Rye, Hastings, St. Leonards, Battle, Hailsham, Eastbourne, Newhaven, Lewes, Brighton, Worthing, Chichester, Horsham, and East Grinstead—all connected with London and each other by railway, and most of them, if I mistake not, belong to the Union. What is to hinder these Institutions, or some of them, combining for the purpose of obtaining lectures at a reasonable rate? Nothing, but local wants and local prejudices. Hastings wants science, it may be; Rye, readings from Dickens or Shakspeare; Battle, lectures on light literature; Maidstone, on music; St. Leonards, on poetry, and so on. But I cannot help thinking that, if we would consent to eschew, to some extent, local predilections, a combination might be formed in this part of England—certainly second to none in the means of mental improvement, in which this town is said to be so lamentably deficient. I do not, by any means, admit this latter assertion, though I do think that Mechanics' and other associated Institutions have it in their power to improve very materially their position, and to increase their usefulness, by a local union such as I have alluded to."

Home Correspondence.

SILK-WORM FISHING GUT.

Sir,—In reply to Mr. Wells, I beg to state on this subject that the precise time for immersing the silk-worm caterpillar in vinegar, is when it has left off feeding, and is looking out for a convenient corner to spin his cocoon.

The silk bag is then perfected, out of which the gut is produced by maceration in strong vinegar. The time for maceration is about three weeks, or more if the weather should be cold and unfavourable. When near the time one or two of the worms are taken out and tried.

After due maceration the worm is broken exactly across the silk bag, and the two parts are drawn gently asunder until the gut appears to be of the proper thickness, and then hung up to dry in the air.

In regard to the vinegar, I hardly know what to say, for in England everything is what it is not. English vinegar is either a chemical compound, with a base of pyroligneous acid, or a villanous compo of sugar and water, spoilt beer, and vitriol.

That used by the Italians is true vinegar, made by the following process:—The husks and stalks of the grapes, after the wine is pressed out, are set by to undergo the acetous fermentation for about three weeks, when they are again submitted to the press, in order to draw off the vinegar, which is perfectly clear and very strong.

HENRY W. REVELEY.

Parkstone, Poole, Dorset, January 12th, 1856.

QUANTITY *VERSUS* QUALITY.

Sir,—The result of the proceedings of our iron masters for the last forty years of peace becomes painfully evident when we pass into the state of war. We have not a piece of ordnance, of any size, that can compete for strength with those of our enemy;—many ineffectual attempts have been made both in the Crimea and at home to burst a Russian gun, and it has been found impossible.

However skilfully scientific men may plan, owing to the wretched stuff of which it is cast, an English gun is quite as likely to explode at the breech as to propel the shot from the muzzle—nor have we been left without some indications of what was to happen; witness the number of cast-iron girders which have broken down of late years without any apparent fault, a disaster that involves the destruction of a certain amount of property and loss of life; but in warfare the bursting of a few guns and mortars may cause the loss of a year, thousands of lives, and millions of money to the nation.

We must no longer allow ironmongers' cast-iron to be used for artillery, and we must establish a better and more scientific mode of casting. It is not sufficient to run the mould full with the liquid metal; there must be a pressure-head of ample weight to force the crystals of the setting metal into close and intimate union. The power of crystallisation is immense, and to compel the union in such a casting as the mortar for the 36-inch shell, there should be a pressure-column of at least 15 feet above the mould. With such powerful hydrostatic pressure, even with our present degraded metal, we should hear no more of breaking girders or of bursting guns and mortars.

A CIVIL ENGINEER.

Proceedings of Institutions.

Bexley Heath.—A *soirée* and exhibition, which were recently held in connection with the Society for the Promotion of Useful Knowledge, are said to have much benefitted the financial affairs of the Society. The exhibition consisted of paintings, bronzes, antiquities and curiosities, contributed by the gentry of the neighbourhood, with the addition of several models and specimens of recent inventions, together with a collection of photographs from the Society of Arts. The exhibition was well attended, and has had an excellent effect.

Cambridge.—The half-yearly meeting of the Philo-Union Literary Society was held at the Society's rooms on Wednesday evening, the 19th ult., when the treasurer presented his report, by which it appeared that the finances of the society were in a most flourishing condition. The librarians also presented their report, showing the library to be in a very prosperous state, 60 new books having been added during the past half-year, and 2112 volumes issued to members during the same period. The following gentlemen were elected officers for the ensuing half-year:—*President*—Mr. Alderman Henry Smith; *Senior Vice-President*—Mr. A. Macmillan; *Vice-Presidents*—Messrs. John Bonnell, Charles Peach, and Charles Baxter; *Treasurer*—Mr. Owen J. Jones; *Secretary*—Mr. George W. Fitch; *Librarians*—Messrs. Thompson, Cooper, and G. Wilderspin.

Lewes.—The lectures at this Institution were commenced on the 27th of September, and have been continued regularly during the quarter. The attendance has been numerous and increasing. In addition to the usual course, the members were gratified by the delivery of an additional lecture, by Dr. Latham (through the influence of R. W. Blencowe, Esq.), on the "Poetry and Ethnography of the Fins." The large number of Fins now located in the war prison at Lewes, rendered this lecture exceedingly interesting. Lord Pevensey has intimated his intention of delivering a lecture during the Session, for the benefit of the Building Improvement Fund. The lectures delivered were, on "Some of the Physical, Social, and Political Changes that have taken place in the History of England," by Mr. R. W. Blencowe; the "Poetry and Ethnography of the Fins," by Dr. Latham; "Characteristics and Demands of the Present Age," by the Rev. N. Haycroft, M.A. (Bristol); "Song and its Influence," by Mr. Cunningham and Miss Payne; on "Light, the Eye, and the Microscope," by Mr. E. Wheeler; "Admiral Blake," by Mr. George Dawson; the "Ottoman Empire," by Mr. J. G. Dodson; on "David Copperfield," by Mr. Grossmith; on "John Milton," by the Rev. H. Crosskey; and on "Cause and Effect," by the Rev. U. de St. Croix.

Wandsworth.—A very interesting and useful lecture was delivered to the members of the Literary and Scientific Institution recently, by Mr. J. Bennett, F.R.A.S., on the "Birth, Parentage, and Education of a Watch." After giving an historical sketch of the gradual development in the art of measuring the lapse of time, from the water-clocks of the Greeks to the latest perfection of a chronometer, and lucidly explaining the construction and meaning of the various parts of a watch, the lecturer gave a description of his recent visit to the watchmakers of Switzerland, which he had been induced to make from witnessing the beautiful display of Swiss watches at the Great Paris Exhibition of last summer. His account of the education, mode of life, and division of labour among these industrious and simple-minded mountaineers, was exceedingly interesting, especially his practical application of the whole of the education question in this country. One imagines beforehand that a lecture on a watch might be rather dry, but those who attended this lecture appeared to be of a different opinion. Dr. Longstaff, in moving a vote of thanks to Mr. Bennett, characterised it as one of the most valuable ever delivered to the Institution. The vote was seconded by the Rev. H. Solly, and carried by acclamation.

To Correspondents.

Erratum.—Page 123, col. 1, line 2 from bottom, for "*not one house of any repute*," read, "*not any of the great houses*."

MEETINGS FOR THE ENSUING WEEK.

Mon. London Inst., 7, Dr. John Tyndall, "On the Nature and Phenomena of Heat."
Chemical, 8.
Statistical, 8, Colonel Sykes, "On the Commerce of British India."

Tues. Royal Institution, 3, Professor Huxley, "On Physiology and Comparative Anatomy."
Syro-Egyptian, 7½.
Civil Engineers, 8, Mr. Henry Robinson, "On the Past and Present Condition of the River Thames."
Med. and Chirurg., 8½.
Zoological, 9.

Wed. London Inst., 3 Mr. Robert Grant, "On Elementary Astronomy."
Roy. Soc. Literature, 4½.
Society of Arts, 8, Mr. G. F. Wilson, "On the Manufactures of Price's Patent Candle Company."
Chemical, 8.

Thurs. Royal Institution, 3, Professor Tyndall, "On Light."
London Inst., 7, Mr. R. Grant, "On the Natural History of Extinct Animals."
Antiquaries, 8.
Royal, 8½.

Fri. Philological, 8.
Royal Institution, 8½, Mr. W. R. Grove, Q.C., "Inferences from the Negation of Perpetual Motion."

Sat. London Inst., 3, Mr. T. A. Malone, "On the Elementary Principles of Animal and Vegetable Chemistry."
Royal Institution, 3, Professor Odling, "On Organic Chemistry."
Royal Botanic, 3¾.
Medical, 8.

PATENT LAW AMENDMENT ACT, 1852.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette January* 11*th*, 1856.]

Dated 29*th August*, 1855.

1951. Charles Pope Rosson, Manchester—Improvements in machinery or apparatus employed for dressing and finishing textile fabrics, by the application of a new material in the place of hogs' bristles or wire cards, hitherto employed therein.

Dated 2*nd October*, 1855.

2197. William Horton, Birmingham—Improvements in the breech part of fire-arms.

Dated 5*th December*, 1855.

2739. William Henry Smith, Wellington-chambers, Cannon-street West—Improved construction of fastening, applicable to gaiters, stays, and other like articles.

Dated 6*th December*, 1855.

2741. Jonas Marland and Samuel Marland, Sun Vale Iron Works, Walsden—Improvements in power looms.
2743. William George Wilson, Penton-cottage, Newington Butts—A pneumatic moderator.
2745. Arthur Paget, Loughborough—Improvements in machinery or apparatus for the manufacture of looped or other fabrics.
2749. James Rock, junior, Hastings—Improvements in the construction of tents, huts, and portable buildings.
2751. Thomas Chaffer, Liverpool, and Jonah Ellis, Vulcan Foundry, near Warrington—Improvements in machinery for sawing and cutting slate, stone, coal, salt rock, or other minerals.
2753. Rudolph Bodmer, 2, Thavies-inn—An improved planimeter. (A communication.)
2755. Angier March Perkins, Francis-street, Gray's-inn-road—Improvements in apparatus for generating steam.
2757. Angier March Perkins, Francis-street, Gray's-inn-road—Improvements in warming buildings and apartments by hot water.

Dated 7*th December*, 1855.

2759. Antoine Latta, Metz—Preparing gutta percha in combination with other substances, applicable to various purposes.
2761. David Dick, Paisley—Improvements in machinery to be used in finishing cloth and textile fabrics.
2763. Hudson Cranston, Coronation-street, Sunderland—Improved method of manufacturing lozenges.
2767. James Leitch, 1, Ellenborough-street, Liverpool—Improvements in melting, blowing up, and filtering sugars and other saccharine matters.

2769. John Gray, Strand-street, Liverpool—Improvements in azimuth and amplitude instruments.
2771. Herman John Van den Hout and Ebenezer Brown, Kentish-town—Improvements in utilising leather shavings.

Dated 8th December, 1855.

2773. Charles François Jules Fonrobert, Berlin—An artificial leech and a sucker.
2775. William Norton, Kirkburton—Improvements in weaving pile fabrics.
2777. François Devos, 2, Rue Drouot, Paris—Improvements in preparing and tanning hides and skins.

Dated 10th December, 1855.

2779. Joseph Wrigley and Jacob Norcliffe, Oldham—Improvements in shuttles, and in the method of using the same.
2781. James Cocker, Liverpool—Improvements in the manufacture of wire.
2783. John Henry Johnson, 47, Lincoln's-inn-fields—Improvements in the manufacture of safety paper. (A communication.)
2787. Josiah George Jennings, Great Charlotte-street, Blackfriars-road—Improvement in the arrangement of the over-flow pipes of baths, wash-hand basins, and other vessels.
2789. Josiah George Jennings, Great Charlotte-street, Blackfriars-road—Improvement in the rising pipe and suction valves of pumps.

Dated December, 11*th*, 1855.

2791. Bernard Hughes, Rochester, New York, U.S.—A knot-tying sewing machine. (A communication.)
2793. Jean Marie Préaud, Lyons—Improvements in india-rubber springs.
2797. John Henry Johnson, 47, Lincoln's-inn-fields—Improved apparatus for discovering the leakage or escape of gas. (A communication.)
2799. Robert Adam Whytlaw and James Steven, Glasgow—Improvements in weaving.
2801. Alfred Vincent Newton, 66, Chancery-lane—Improved machinery for manufacturing bolts. (A communication.)
2803. Samuel Clarke, Albany-street, Regent's-park—Improvements in lanterns for affording light, and for cooking.

Dated 22nd December, 1855.

2900. Myles Kennedy, Ulverstone, and Thomas Eastwood, Preston—Improvements in pump buckets, which improvements are also applicable to lift pumps, air pumps, and all similar apparatus.
2902. John Henry Johnson, 47, Lincoln's-inn-fields—Improvements in furnaces for steam boilers and other heating purposes. (A communication.)
2904. Christopher Dresser, Waterloo-cottage, Waterloo-street, Hammersmith—Improvements in the mode of effecting what is called "nature printing."
2906. Edward Rowcliffe, 2, Gloucester-terrace, West-grove, Blackheath—Improvements in the manufacture of blocks or slabs for paving or building purposes.
2908. David Dick, Paisley—Improved regulator for gas.

Dated 24th December, 1855.

2910. Frederic Holdway, 12, Mount-street, Grosvenor-square—Improvements in carriages and various parts of the same.
2912. Thomas Cowburn and George Walker Muir, Manchester—Improvements in steam boilers, and in valves and parts connected therewith.
2914. Christian Ernst Offhaus, Newark, U.S.—Improvements in rotary steam engines.
2916. John Barton, Stockport—Improvements in shuttles or shuttle tongues.

Dated 26th December, 1855.

2918. Alexandre Tolhausen, 7, Duke-street, Adelphi—Improvements in railway axle-boxes. (A communication.)
2920. John William Lewis, Manchester—Improved picker for looms.
2922. Sylvanus Sawyer, Massachusetts, U.S.—Improved bomb shell.
2924. David McCullum, 3, Victoria-place, Stonehouse—Improvements in electric telegraphs.

Dated 27th December, 1855.

2926. Simon Petit, Versailles—Improved apparatus for buoying ships or vessels, and also drawing them out of water.
2928. Alfred Krupp, Essen, Prussia—Improvements in guns and gun carriages.
2930. Edwin Ladmore, Birmingham—Improved method of securing ramrods to military fire-arms.
2932. John Grist, Islington—Improvements in machinery for the manufacture of staves and parts of casks, and for forming them into casks, barrels, and other like vessels.

Dated 28th December, 1855.

2934. John Robinson, and Richard Cunliffe and Joseph Anthony Collet, Atlas Works, Manchester—Improvements in locomotive steam-engines, and in springs for locomotive steam-engines and other purposes.
2936. Thomas Fielding Uttley, Mytholm Royd, York—Improvements in the mode of applying fusible plugs to steam-boilers.
2938. George Chisholm, St. John's-square, Clerkenwell—Improvements in the manufacture of artificial manure.
2940. Henry George Baily, Vicarage, Swindon—Improvements in machinery for digging and forking land.

WEEKLY LIST OF PATENTS SEALED.

Sealed January 10th, 1856.

1544. Henry Pratt.
1552. Thomas Wright Gardener Treeby.

Sealed January 12th, 1856.

1557. Benjamin Greening.
1558. John Robinson and William Wedding.
1560. Frederic Howorth Edwards.
1565. Romain Denis Obissier.
1566. Joseph Henry Tuck.
1568. Thomas Redmayne.
1571. George Tomlinson Bousfield.
1592. Ludovico Gavioli.
1620. Auguste Edouard Loradoux Bellford.
1623. Vincent Scully and Bennett Johns Heywood.
1627. James Gray Lawrie.
1646. Casimir Deschamps and Charles Vilcoq.
1648. William Striby.
1661. Rev. Theophilus Henry Hastings Kelk.
1673. Joseph Westwood and Robert Baillie.
1681. Tony Petitjean.
1718. François Georges Hyacinthe Levasseur.
1749. James Saunders.
1785. Samuel Cunliffe Lister.
1865. William Hudson.
1967. John Gedge.
2237. James Torry Hester.
2257. William Henry Lancaster and James Smith.
2277. John King Westropp and Edward Alfred Sharman.
2285. Henry Gardner.
2345. William Basford.
2362. Pierre Alexandre Leroux and Louis Réné Martin.
2498. Charles Hart.

Sealed January 15th, 1856.

1591. Antoine Regazzoli.
1594. Joseph Henry Tuck.
1614. William Smith.
1622. Vincent Scully and Bennett Johns Heywood.
1632. John Henry Woolbert.
1638. Samuel Stocker.
1742. Richard Archibald Brooman.
1756. Joseph Lane.
1762. Richard Albert Tilghman.
1784. Caleb Bedells.
1810. William Mickle.
1816. Auguste Morin.
1826. Charles Evans Reeves.
1828. Louis Turletti.
1848. Samuel Statham and Willoughby Smith.
1914. Frederick Scott Archer.
1940. William Johnson.
1954. Charles Radcliffe.
2278. Richard Albert Tilghman.
2464. James Greenshields.
2530. Joseph Scott.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

January 2nd.

45. Thomas Pape.

January 4th.

25. Charles Frederick Whitworth.
26. Francis Edwards.

January 5th.

36. Robert Whinery.
75. John Petrie, jun., and Samuel Taylor.
320. John Whitehouse, sen., and John Whitehouse, jun.
501. Edward Hammond Bentall.

January 7th.

59. Francis Parker and William Dicks.
82. John Arrowsmith.

January 8th.

69. Joseph Beattie.

January 10th.

71. Henry Constantine Jennings.
72. James Thornton, John Thornton, and Albert Thornton.
80. James Fletcher.
88. Frederick Lawrence and Alfred Lawrence.

January 12th.

93. John Rumley.
102. Frederick Joseph Bramwell and Isham Baggs

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
3801	January 3.	Joints or Connections for a Stove	John Jobson	Litchurch Works, Derby.
3802	„ 3.	Pressure Guage	Edward Davis	Leeds.
3803	„ 16.	A Swivelical Screw Barrel Tilt	Richard Frost	8, Wilson-street, Gray's-inn-road.